NEWS RELEASE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
400 MARYLAND AVENUE, SW, WASHINGTON 25, D.C.
TELEPHONES: WORTH 2-4155 —— WORTH 3-1110

FOR RELEASE: UPON DELIVERY

Address by
James E. Webb, Administrator
National Aeronautics and Space Administration
at the
Webb School Alumni Association Testimonial Dinner
Los Angeles, California
April 26, 1962

* * *

Eleven months have passed since May 25, 1961, when President Kennedy proposed that the nation accelerate its space program. The President advocated, and Congress endorsed the goal of landing men on the moon in this decade, a goal that I am convinced we must endeavor to achieve.

We should not lose sight, however, of the underlying purpose of the Manned Lunar Landing Program. It is not alone to reach the moon, but to create for this nation a space capability second to none -- a capability for the full exploitation of space in the national interest, whatever that interest should require.

This may mean intensive manned exploration of the moon and planets.

It will most certainly mean the development of operational satellite and space laboratory systems, some of which will need manned space flight support.

It will mean a continuing advancement in fundamental knowledge, as a basis for future development in space and on earth. And it may mean the utilization of our space capability for the defense of the free world. If we keep this underlying purpose in mind, we shall not lose sight of the fact that manned lunar landing is not the end, but an objective that marks a major milestone on the way toward a national space capability sufficient for any purpose the future may demand.

The exploration of space is the most challenging assignment ever given to the American scientific, engineering, and industrial community. And its requirements for large-scale organized efforts spread over a broad national front, will task our capacity to utilize both governmental and private resources efficiently and effectively.

In addition to manned space flight, the national program for carrying out all phases of this exploration has many objectives, including:

> Broad-scale, rapid advancement of scientific knowledge of space, the sun and the earth, and of the moon and planets;
>
> Creation of a worldwide operational network of weather satellites;
>
> Establishment of a global satellite system for teleradio communications;
>
> Applications of space technology to our economy and to benefit the world; and
>
> Creation of a complex of scientific and technological resources, both men and machines, capable of insuring the continuance of our national preeminence in research and development.

Technological advances through our space efforts will, I am convinced, bring us total benefits exceeding those of any other scientific and technical undertaking in history, dwarfing every previous opening of new territories and new knowledge.

We know that men have dreamed of flying for more than two thousand years, as long ago as the ancient Greek legend of

Daedalus and Icarus. Until the work of the Wright Brothers, however, man lacked an energy source small and light enough to be carried aloft, yet powerful enough to fly him. The experiments of Wilbur and Orville Wright at Kitty Hawk proved that manned flight at long last was feasible, and humanity's conquest of aerospace began.

With the continued development of more powerful engines through the 45 years from the flight of the Wright Brothers to the availability of modern jet aircraft, we have constantly improved our means to overcome the pull of gravity and to transport men, materials, and devices farther and higher in the atmosphere.

A decade ago, we developed an airplane that could fly faster than sound, at 700 miles per hour. Now we have the X-15 rocket plane that has passed the 4,000 miles-per-hour mark.

In the past decade also, we developed the modern rocket to boost satellites into orbit around the earth at speeds of 18,000 miles per hour. Two years ago, we were able to attain speeds of 25,000 miles per hour, which has made it possible for us to send instrument-packed scientific craft into deep space to distances that our earthly minds can scarcely comprehend.

The prime mover of man's ventures into space is a device that the ancient Chinese used for celebrations and to frighten enemies in battle, that has served many nations for signaling in warfare and in sea and coastal rescue work, that in 1812 the British employed "with red glare" in an unsuccessful attempt to destroy Ft. McHenry at the entrance of Baltimore Harbor, and that has been employed by weather services to sample meteorological conditions many miles above the earth's surface.

I refer, of course, to the rocket.

The rocket has come incredibly far since the simple cardboard tube, burning black powder, that has delighted us all on the Fourth of July by whooshing a few hundred feet into the air and bursting into sprays and stars.

The modern rocket had its origin in the research -- largely ignored during his lifetime -- of Dr. Robert H. Goddard in the 1920's and 1930's. I might add that it was in his honor that we named the Goddard Space Flight Center, near Washington.

Thanks to Dr. Goddard's pioneering efforts, the modern rocket whether its fuel is a liquid or a solid chemical, does not need the oxygen of the air in order to burn and develop tremendous thrust power. It carries its oxidizing agent with it, and thus can operate in the airless near-emptiness and vacuum of space.

Furthermore, modern rockets do not require the atmosphere as their medium of flight support as do aircraft. In fact, rockets operate with much greater efficiency in space where they are free of the drag, turbulence, and friction-heat of the air.

These are the basic reasons why rockets can deliver the fantastic speeds we must have for sending spacecraft into earth orbits or to the moon and beyond.

You may be interested to note that in this case the technology required to make and fly powerful rockets, involving the most efficient use of energy, new lightweight materials, and very complex systems of electronics, had to precede the scientific work which these rockets made possible. And it follows that a large part of the work of the National Aeronautics and Space Administration is devoted to the technology of the rocket and that, therefore, a large proportion of the cost of the Nation's space program goes to design, test, build, transport, launch, keep track of, and use these advanced types of rockets.

By way of background, the first six decades of this century have been years of revolutionary change. Empires have fallen. Upheaval has shaken such vast regions of the world as Russia, China, the Middle East. New nations are emerging. Communist dictatorships have arisen to challenge constitutional democracy and the right of peoples to self-determination.

This period also saw the development of the modern rocket that has ushered in the Space Age.

Now briefly, what has our National Space Program achieved?

Fresh in all our minds is the magnificent performance and highly successful Project Mercury flight of John Glenn in three orbits around the earth.

I could also mention the discovery of the Van Allen radiation belt and other pioneering discoveries in space science.

The first test launching of the powerful, one million, three hundred thousand-pound thrust Saturn rocket was made last October -- the most powerful rocket ever flown, so far as we know. I could tell you about the almost incredible pointing accuracy of OSO I, our new Orbiting Solar Observatory, which was launched one week after the Glenn flight and, as it circles the earth at a distance of 350 miles, keeps a battery of complex instruments pointed directly and continuously not just at the sun, but at a spot at the very center of the sun, some 93 million miles distant.

Then there are the impressive number and the wide variety of our scientific satellites. The United States has launched nearly 70 satellites which have carried valuable scientific experiments. The experience we have gained in space technology to achieve these launchings is an impressive achievement in itself.

Some of you who may be particularly interested in radio communications might know that our Pioneer V deep-space probe continued reporting back to earth by radio until it had passed a distance of more than 22 million miles out in space on its way to become a satellite of the sun.

With an eye to the future, you might say our most impressive performance to date has been the hard decisions by President Kennedy and Congress that went into planning our accelerated program to land a team of explorers on the moon and return them safely to earth in this decade.

When it comes to putting our new knowledge of space science and space technology to work to serve our best national and international interests, certainly remarkable progress has been made toward establishing satellite networks for worldwide teleradio communications, weather reporting and analyses, and aid to navigation on the seas and in the atmosphere.

From the standpoint of the development of human resources, our greatest space achievement may well be the building of a team, or group of teams, of highly capable, creative, and enthusiastic scientists, engineers, and technicians -- in industry, the universities, and in Government -- to carry out our space program.

I suggest that all these achievements in the space program and many others worthy of recognition, would still not equal our major achievement in space -- for the whole is greater, far greater, I think, than the sum of the parts.

This country's greatest achievement in space, in my opinion, has been the creation of a truly major national effort -- as dynamic as it is urgent -- for mobilizing large resources of scientific knowledge and advanced technology to achieve clearly defined national goals.

The significant fact of this decade, I submit, will be more than the landing of a team of United States explorers on the moon; it will be the demonstration of the will and ability of our Nation, in full observance of the democratic processes of a free people, to organize and carry out the great effort that makes such a landing possible.

In the past, our major national undertakings have largely been of two kinds -- the intensive and highly organized efforts made in wartime and the competitive efforts of many firms and individuals which, because of their common direction, have time and again added up to drives of the first magnitude.

I do not need to go into detail about the vast, complex, and swift-moving scientific and technical campaigns we have mounted in wartime, from World War I up to, and including, our present progress in forging the weapons that will deter aggression and protect our freedom tomorrow.

As to efforts in time of peace, of course, every nation works continuously -- some more effectively than others -- to feed and clothe its people and promote their welfare. I am not thinking of that, but of extraordinary efforts on a grand scale toward a chosen goal.

A striking example was the westward movement and settlement of this country over a period of 300 years. It was stimulated, in part, by government action such as generous grants of land for roads, railways, and for homesteading. But essentially, it was a movement growing out of individual initiative and individual effort, without a master plan.

Let me give you just two good examples. Samuel F. B. Morse invented the telegraph in his own workshop. The only help he asked -- and got -- from the government was the modest sum of $30,000 which Congress granted for stringing a test line from Washington to Baltimore.

After World War II, the time was ripe for television. In a remarkably short time, private enterprise and individual demand equipped almost every home with this instrument and an industry was created, almost overnight.

However, in this new age of science and technology, there are some doors to a better future for mankind that individual effort, alone, simply cannot unlock.

Congress recognized this fact when the Atomic Energy Commission was created in 1946 to put the power of the atom to work for the common good, as well as to meet military needs.

The business community could organize and finance the research and development necessary to give the Nation television at reasonable cost, just as it had given almost every home and office a telephone and radio, and almost every family its own automobile.

Taming the atom was a different matter. The scientific effort required, the creation of a new technology, requirements for public safety, the tremendous investment needed for test facilities -- not to mention manufacturing processes -- all these were beyond the scope of American industry at the time.

I say "at the time" because that indicates another dominant characteristic of the age in which we live.

When Faraday demonstrated the principle of induction in 1831, the world was content to wait nearly five decades for Edison and others to produce the first clumsy dynamos.

Today, tremendous pressures are at work to shorten the gap between scientific discovery and practical application. These pressures include defense needs, and the demand for new products and new techniques to satisfy the needs of rapidly expanding populations in our highly organized urban society. The pressure also includes the competition between rival systems of social and economic organization in the international arena.

After World War II, there was a great national debate, but quick agreement, that this country should not delay development of ways and means to put the atom to work until this would be commercially feasible. It was agreed that the Federal Government, through the agency of the Atomic Energy Commission, should organize and direct the pioneering effort, but also make maximum possible use of the capabilities and resources of industry, the universities, and other established institutions.

A similar step was taken in 1950, when the National Science Foundation was formed as a Federal agency to encourage and support a wide variety of scientific research projects, ranging all the way from highly individualistic one-man projects to huge undertakings requiring heavy investment in technology, such as Project Mohole to drill through the earth's crust and into the underlying mantle for the first time, or the giant radio telescopes which bring us new information from the farthest reaches of the universe.

In 1958, when it was obvious that we had fallen behind the Soviet Union in building rockets needed for space exploration, Congress -- after a great national debate -- voted to establish the National Aeronautics and Space Administration. The agency would have thorough scientific and technological competence in the related fields of aeronautics and space, and would emphasize ways in which science and technology could be used for the general welfare. NASA was built around the National Advisory Committee for Aeronautics, the Jet Propulsion Laboratory of the California Institute of Technology, the Army's von Braun group at Huntsville, Alabama, and elements of the Naval Research Laboratory.

The law requires of NASA a long-range plan, and this was established under the Eisenhower Administration. That plan laid out a progression of space research and exploration events toward which to work over a period of about 15 years.

Last year, when faced with ever more rapid Soviet progress in space, President Kennedy reviewed the long-range plan. With the help and advice of Vice President Johnson and the National Aeronautics and Space Council, he determined that it is feasible to compress 15 years of progress under the old plan into a decade under a new plan.

The President proposed, and Congress endorsed, a program to do just that, and we have set the accelerated plan in motion.

In establishing NASA to direct the Nation's peaceful space program, Congress clearly called for a regrouping of forces and the mobilizing of the scientific and industrial resources of the Nation to gain American pre-eminence in a field vital to our security, our welfare, and to our capacity for world leadership.

The creation of NASA, plus the accelerated program and clear goals set during the last 12 months, have already set in motion a major national effort to regain and maintain a position of leadership in all aspects of space exploration and in the broad fields of space science and space technology.

This national effort in space has certain key features which underline its importance as a factor in our daily lives and as a classic example of how free men can handle the complex problems of a scientific and technological age. These key characteristics are:

1. The accelerated space effort meets clear national needs. Without it, we would risk quickly becoming a second or third rate power in an unfriendly world.

2. Each Government agency that has a responsibility or a role to play is involved: the State Department, the Department of Defense, the Weather Bureau, the Federal Communications Commission, and, of course, NASA.

3. The effort is based on the widest possible participation by industry, the universities, other non-profit institutions, and individual citizens.

4. The effort is going forward as openly as possible, and with full benefit of guidance from the scientific community.

5. The money invested in the program, going as it does into basic research and advanced technology, as well as into operations, will act as a stimulus to national growth in an age when to go forward slowly is to fall behind.

History affords us many examples of the manner in which man's striving toward difficult technical goals has brought on broad and far-reaching consequences. A dramatic example was the attempt to apply primitive steam power to pump mines and to operate textile machinery in England. This gave birth to the industrial revolution, with all its political and economic consequences because it spurred research in such fields as materials, metallurgy, thermodynamics, chemistry, and physics. And this research, in turn, provided information necessary to construct even better machines and engines to power them.

Crude as the beginnings were, they led to modern mills and factories, to railroads, steamships, automobiles, and eventually to airplanes, rockets, and spacecraft.

Two aspects of such major advances are characteristic:

First, the practical results are largely unforeseeable, primarily because they develop on broad fronts and, frequently, in unsuspected directions.

Second, the concentration of effort required does not diminish effort expended on other frontiers of knowledge, but rather spurs such activities. For example, despite fears that space technology would monopolize the scientific effort of this country, such fields of activity as oceanography, geophysics, and the physics of high-energy particles have greatly increased since the national space effort has become a serious one.

In this rapidly moving new era, space and its implications for every walk of life should become part of the understanding of every citizen, young or old.

Education is more essential than ever in the Space Age. The uneducated man or woman will have fewer opportunities than in the past, and the need is especially great for specially gifted students to be stimulated intellectually to lay a sound foundation and then move ahead in the many fields being opened by our space activities. And this stimulus is needed for girls as well as for boys so that they can cope with the world of tomorrow.

In that world of tomorrow, science and technology will be nearing solutions to the age-old problems of adequate food, health, materials, housing, transportation, and power sources. To realize the full benefits of this program, intellectual talent properly developed and provided opportunities to work and create will be our most valuable national resource.

What are the space vehicles which we are building for the future, and those which we have already developed and are using today? First let me describe the National Launch Vehicle Program.

At present, the national program consists of 10 vehicles in ascending order of size. Responsibilities have been divided between NASA and the Department of Defense. NASA develops six of the vehicles and the Air Force, as agent for the Department of Defense, is responsible for the remaining four. All 10, however, are available to any agency of Government having work to do in space.

The smallest of the 10 vehicles is Scout, a four-stage solid-propellant rocket developed by NASA, which has the capacity of placing a 150-pound satellite in orbit.

Next is the Delta, also developed by NASA, which has a capacity of placing 500 pounds in orbit. It consists of three stages, liquid fueled in the first two and solid fueled in the third.

The Thor-Agena B, an Air Force vehicle, is third in line. Its two liquid-fueled stages can lift a 1,600-pound satellite into low orbit.

Fourth is the Air Force Atlas, a liquid-fueled rocket that NASA employs to boost the 2,700-pound Mercury spacecraft into orbit.

Vehicle No. 5 is the Atlas-Agena B, an all-liquid-fueled vehicle, the most powerful in current use, with the capacity of lifting 5,000 pounds into earth orbit.

The sixth vehicle in size is a new one, the Titan II, which the Air Force began to flight-test last month as the booster for intercontinental missiles, and which should become available to carry payloads for NASA missions late next year. The Titan II, with an orbital payload capacity of more than 6,000 pounds, will burn liquid fuel that can be stored in the rocket, thus permitting launchings on short notice.

Next is the Centaur, which will employ a radically different kind of fuel, liquid hydrogen, in an upper stage above a modified Atlas. The Centaur will have the capacity of lifting 8,500 pounds into earth orbit. NASA is managing the development of the Centaur and all larger launch vehicles.

Vehicle No. 8, the Saturn C-1, is the largest American vehicle which has reached the flight-test phase. Under development since 1958, the Saturn C-1 is a two stage vehicle which will have the capacity of launching 15,000 to 20,000 pounds into orbit when it begins carrying useful payloads late next year. This week, we plan to carry out the second flight test of the Saturn C-1 first stage, with water-filled upper stages as ballast.

The ninth and largest vehicle currently under development is the Advanced Saturn, which will have a first stage five times as powerful as the Saturn C-1 and a payload capacity 10 times as great. Development of the Advanced Saturn began late last year. When it becomes available four or five years from now, it will be able to place 200,000 pounds in low orbit or speed 85,000 pounds out into deep space.

The largest vehicle in the national program is the Nova, a booster which will almost double the capability we have with the Advanced Saturn. It will enable us to lift 375,000 pounds into earth orbit or speed 150,000 pounds to deep space. If Congress approves the funds recommended by President Kennedy, we plan to begin development of the Nova during the next 12 months.

Let me now discuss the spacecraft that NASA is developing to be carried by these launch vehicles. The program breaks down into four major areas--advancement of science, useful applications, development of manned space flight, and advancement of aeronautical and space technology. We are developing spacecraft in all of these areas of our work.

In the space sciences, we are exploring the upper atmosphere and the universe beyond earth to learn basic information. In the space science investigations, we employ a number of tools--ground observations, balloons, sounding rockets, satellites, and craft that probe deep into space beyond the earth. Where possible, we employ the less expensive means, such as ground observations, balloons, and sounding rockets, which rise up through the atmosphere into space as high as 4,000 miles, and then fall back to the earth, radioing or telemetering scientific data. There is not time tonight, however, to discuss all the smaller spacecraft used at less than orbital velocities.

The earth satellite goes into orbit, and therefore makes it possible to make scientific observations over a longer period of time. Until recently, we were limited by the capacity of our launch vehicles to satellites of relatively small size and weight. We still plan to employ a limited number of smaller scientific satellites. But in the years to come, we intend to carry the great bulk of our scientific satellite experiments on multi-purpose observatory spacecraft, which will provide a common base in orbit for a large number of coordinated observations.

The first of these large observatories is already in orbit. On March 7, we employed a Delta vehicle to launch the first Orbiting Solar Observatory--OSO for short--a spacecraft weighing 458 pounds carrying 13 well-planned scientific instruments. It is in an orbit with average height of 350 miles. Over many months, these instruments will make simultaneous measurements that will vastly expand our knowledge of earth-sun relationships as well as that required for manned space flights of long duration. The OSO will be employed again and again over the next 11 years to cover a complete sun-spot cycle.

Next year, we plan to launch a standardized satellite twice as large as the OSO, in a highly elongated orbit that will carry it about 70,000 miles deep into space. This next satellite, called the Orbiting Geophysical Observatory--OGO for short--will carry perhaps 19 different experiments that will measure phenomena related to the earth itself or in the neighborhood of the earth. The first flight of the OGO will employ the boost capacity of the Atlas-Agena B. Later, we plan to send an OGO satellite into a lower orbit that will cross the north and south polar regions. For that flight the power of the Thor-Agena B will be sufficient.

A still more advanced standardized satellite will be the Orbiting Astronomical Observatory, with which we will carry instruments above the atmosphere to make observations of distant stars and galaxies as well as objects in our own solar system. The OAO, weighing 3,300 pounds, will be launched by the Atlas-Agena B into orbits of about 500 miles above the earth. One of the instruments planned for the OAO satellites is a 36-inch telescope.

The more powerful launch vehicles also make it possible to undertake a number of advanced investigations of the moon, the planets, and the space in between. Obviously, we require considerably greater power to send a spacecraft to the moon than merely to place it in orbit about the earth. Still greater power is required when we wish to land a spacecraft on the moon or a planet.

Now let me discuss our investigations of the moon. The first of our lunar landing spacecraft is the Ranger, the fourth of which was launched on Monday afternoon. The Atlas-Agena B launches the Ranger, whose total weight is 730 pounds, to the vicinity of the moon. Then the spacecraft divides in two and a retrograde rocket slows down one portion, weighing 89 pounds, so that it strikes the moon at a speed of less than 150 miles per hour. The scientific instruments are packaged in balsa wood designed to protect them from the impact. After landing, one of the instruments will record vibrations caused by moonquakes and impacts of meteorites on the moon's surface.

The other portion of the spacecraft will crash into the moon at a speed of about 4,000 miles per hour and will be destroyed. On its way down, however, it is designed to take pictures of the surface and televise them back to the earth, measure gamma rays, and test the radar reflictivity of the surface. A later version of Ranger will carry television cameras of higher resolution, which will dispense with the retro rockets and so will be totally destroyed on impact.

Following the Ranger program will come the Surveyor spacecraft, which will employ the greater capacity of the Centaur launch vehicle to make it possible to land a spacecraft softly on the moon. The Surveyor, weighing 2,100 pounds before it begins its descent to the moon, will land about 100 pounds of instruments on the surface.

We are thinking about the concepts for a spacecraft beyond Surveyor, which will take advantage of more powerful vehicles which will have the capacity to place spacecraft weighing up to perhaps 20,000 pounds or more on the moon's surface.

In the exploration of the planets we are limited to rather rigid schedules, because we have to launch at times when the earth and the other planet are approaching their closest point. At present, there are really only two planets, Venus and Mars, that are reachable. Venus is in favorable position every 19 months; Mars every 25 months.

One of the opportunities to measure phenomena near Venus comes up this summer. By firing two spacecraft in the month beginning in the last few days of July, we hope to get one to pass near the planet, in what we call a "fly-by." The first Venus spacecraft is called the Mariner R. Launched by the Atlas-Agena B, it is similar in design to the Ranger and weighs about 460 pounds.

When the Centaur becomes available, we expect to build a larger version of the Mariner, called Mariner B, which will weigh between 1,000 and 1,300 pounds. We plan one Mariner B flight to investigate interplanetary space in 1963. Then in 1964, four Mariner B launchings will attempt to fly by both Venus and Mars.

As with the lunar program, we are also thinking of what can be done with the greater capacity of heavier launch vehicles. With spacecraft weighing 20,000 pounds or more, we shall have the opportunity to go into actual orbit around a planet with the main spacecraft, take television photographs of the planetary surface, and then detach a landing capsule that can radio information from the surface of Mars or Venus. In such capsules, we could carry devices that might detect the presence of life on the planet.

The second major area of the NASA program is applications. The two farthest advanced applications of satellite technology are in meteorology and communications. In meteorology, we have had four successful launchings of TIROS satellites in four attempts. Last fall, information radioed by TIROS III told the weather services about an Atlantic Hurricane two days sooner than would have been possible otherwise.

The TIROS is a satellite weighing about 280 pounds, launched by a Delta vehicle. It has television cameras that take pictures of the cloud cover and radiation instruments that measure the temperature of the earth's surface and cloud tops below it. Information obtained by both of these systems is recorded on tape and transmitted to earth stations when the satellite passes near the stations.

The TIROS maintains its orientation in space by spinning. It acts like a gyroscope. Consequently, its instruments are pointed away from the earth much of the time. In the next six to nine months, we plan flight tests of the Nimbus, a larger weather satellite that will have automatic controls to keep it always pointed toward the earth. The Nimbus, which will weigh about 600 pounds, will be launched by the Thor-Agena B.

The Nimbus will be in an orbit of about 500 miles altitude over the poles of the earth. A still more advanced weather satellite program is Aeros, in which we plan to develop a satellite that will revolve about the earth from west to east at an altitude of 22,300 miles over the equator. At this altitude, a satellite revolves about the earth in exactly 24 hours. A satellite orbiting at that altitude would thus appear to hover over a point on the equator. The Aeros will have a variable focus lens on one of its television cameras, which will make it possible to observe a developing storm system over a period of time, instead of taking a glance each time the orbiting satellite passes by. The Aeros will be boosted by the Centaur launch vehicle.

In communications, we have four major experiments scheduled in the balance of this year.

Three of the four are called active satellites because they carry radio receivers and transmitters that act as relay stations in space. The fourth is called passive because it merely passively reflects the radio signal.

The first of the acting satellites is Project Relay, a Government project. The other, Project Telstar, is a project of the American Telephone and Telegraph Company. AT&T will reimburse NASA for the cost of the Telstar launchings. Both Relay and Telstar will launch active satellites into orbits with altitudes of 3,000 to 6,000 miles. They will test the life of the components, measure the space environment continuously, and will demonstrate intercontinental television.

The third type of active satellite is the Syncom, which will investigate problems involved in launching satellites to the 22,300-mile altitude required for the 24-hour orbit. The first Syncom, weighing 55 pounds, will be launched by the Delta plus a small solid-propellant fourth stage.

Many of those in this room may be familiar with the passive communications satellite project called Echo, under which a 100-foot balloon was placed in orbit in the summer of 1960. Echo is a highly visible satellite. When it was launched, it was one of the brightest objects in the sky. It is still visible, although it is not now quite so bright because cosmic dust has punctured the skin, allowing the gas to escape, and the surface is now quite wrinkled.

The next Echo will be larger, with a diameter of 135 feet--and the skin will be stiffer--better to retain its shape, we hope. The first Echo, which weighed less than 200 pounds, was boosted by a Delta. We shall employ a Thor-Agena B to launch Echo II, which will weigh about 650 pounds.

Later, we plan to investigate the feasibility of launching three such spacecraft with a single rocket into orbits over the poles, employing the greater capacity of the Atlas-Agena B. This three-in-one spacecraft is called Rebound.

Manned space flight is the third major area of NASA interest. You are all familiar with Project Mercury, which reached its initial goal in John Glenn's flight on February 20, and so I shall not dwell on that. The Mercury spacecraft weighs 2,700 pounds and maintains a single astronaut in orbit for a flight lasting almost five hours. We employ the Atlas as a booster. Early next year, we plan to modify the Mercury spacecraft to allow it to remain in orbit as long as 24 hours.

The next phase of the manned space flight program is Project Gemini, in which we plan to orbit a two-man spacecraft weighing more than 6,000 pounds for periods lasting as long as a week. Boost power will be provided by the Tital II.

Gemini flights will begin next year. By 1964, we hope to begin experiments in rendezvous and docking the Gemini with an unmanned spacecraft in orbit about the earth. The target spacecraft will be an Agena B stage, launched by an Atlas.

The Apollo three-man spacecraft makes up the third phase of our manned flight program. The basic Apollo will weigh about 12,000 pounds and for test and operational flights will be boosted into orbit by the Saturn C-1. There will also be a service section for Apollo that may bring the total as high as 20,000 pounds for longer missions.

In a second portion of the program, a specially prepared Apollo craft will be launched on a series of flights deeper and deeper into space, culminating in a flight around the moon.

On these flights, the Apollo will need to carry a large auxiliary rocket that will enable the spacecraft to reverse its direction rapidly and return to the earth should the sun suddenly flare and loose a dangerous burst of radiation. Power for these flights will be provided by the Advanced Saturn.

For a direct flight to a manned landing on the moon, the power of the Nova will be needed. On lunar landing flights, the 12,000-pound Apollo spacecraft must carry two additional rockets--one to slow its fall toward the moon for a landing, and another to take off from the moon. Thus, a total weight of about 150,000 pounds must be accelerated to a speed of 25,000 mph to accomplish the manned lunar landing.

The Nova will take a long time to develop. Consequently, we are investigating an optional method of speeding this 150,000 pounds out into deep space. If we can perfect the technique of rendezvous and docking in earth orbit, the Apollo payload can be launched separately in two packages by two Advanced Saturns and then joined together. We may save as much as two years if this can be done. There is no assurance of this, however, and even if so, there is no assurance that it can be done in time. Therefore, both the Advanced Saturn and the Nova are included in the lunar landing program. Both are needed also in the period after we land on the moon.

The fourth major area of the program is advanced research and technology. Most of this research is performed on the ground. A few of these experiments, however, involve flight projects.

One is the effect of cosmic dust particles on the outer skin and structure of satellites and spacecraft. Later this year, a Scout vehicle is scheduled to launch a 135-pound satellite, now carrying the prosaic name S-55b, which will investigate this situation.

Another spacecraft, under development in a new project called FIRE, will explore the conditions involved when objects return to the earth's atmosphere at 25,000 miles per hour from the vicinity of the moon. Beginning in 1963, an Atlas booster will launch the test spacecraft, weighing 200 pounds, into a deep-space trajectory. On the way back down, a large solid-propellant rocket will speed the craft to the required velocity.

Another area of advanced research is in electrical propulsion, which may provide a more efficient means than chemical rockets for accelerating spacecraft to the speed required for exploring the planets. Electrical rockets, whose electric power is normally generated by nuclear reactors, are expected to provide a more efficient use of fuel.

Flights scheduled late this year and early next year will test whether two types of electrical propulsion actually work in deep space. Each of the spacecraft, called SERT, will carry an ion engine and two arc-jet engines to altitudes of about 4,100 miles. A Scout vehicle will provide boost power to launch the 200-pound spacecraft.

A most important phase of advanced technology is our investigation of nuclear propulsion--sometimes called nuclear-thermal propulsion--in Project Rover. The nuclear rocket differs from chemical propulsion in that the exhaust gas is heated directly by passing it through a nuclear reactor, rather than burning it with oxygen.

At present, we are investigating various types of reactors in preparation for selecting one for a flight vehicle, which we hope to launch with a Saturn first stage in the period 1966-67. As we solve the problems involved, we believe that by substituting nuclear-powered upper stages for those powered by chemical rockets, we can ultimately increase payloads by a factor of two or more.

I hope I have made clear what I meant when I said that the major achievement in space to date has not been this rocket, or that satellite, or even a series of outstanding demonstrations of human skill and courage. It has been the creation of a truly national effort by the people of the United States in order to achieve our national goals in space.

An increased public understanding and appreciation of this national effort as it unfolds is vital if this democracy, as President Kennedy has phrased it, is to take the "clearly leading role in space achievement which in many ways may hold the key to our future on earth."

# # #